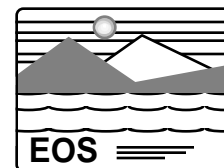




## EOS AM-1 Mission Operations Review

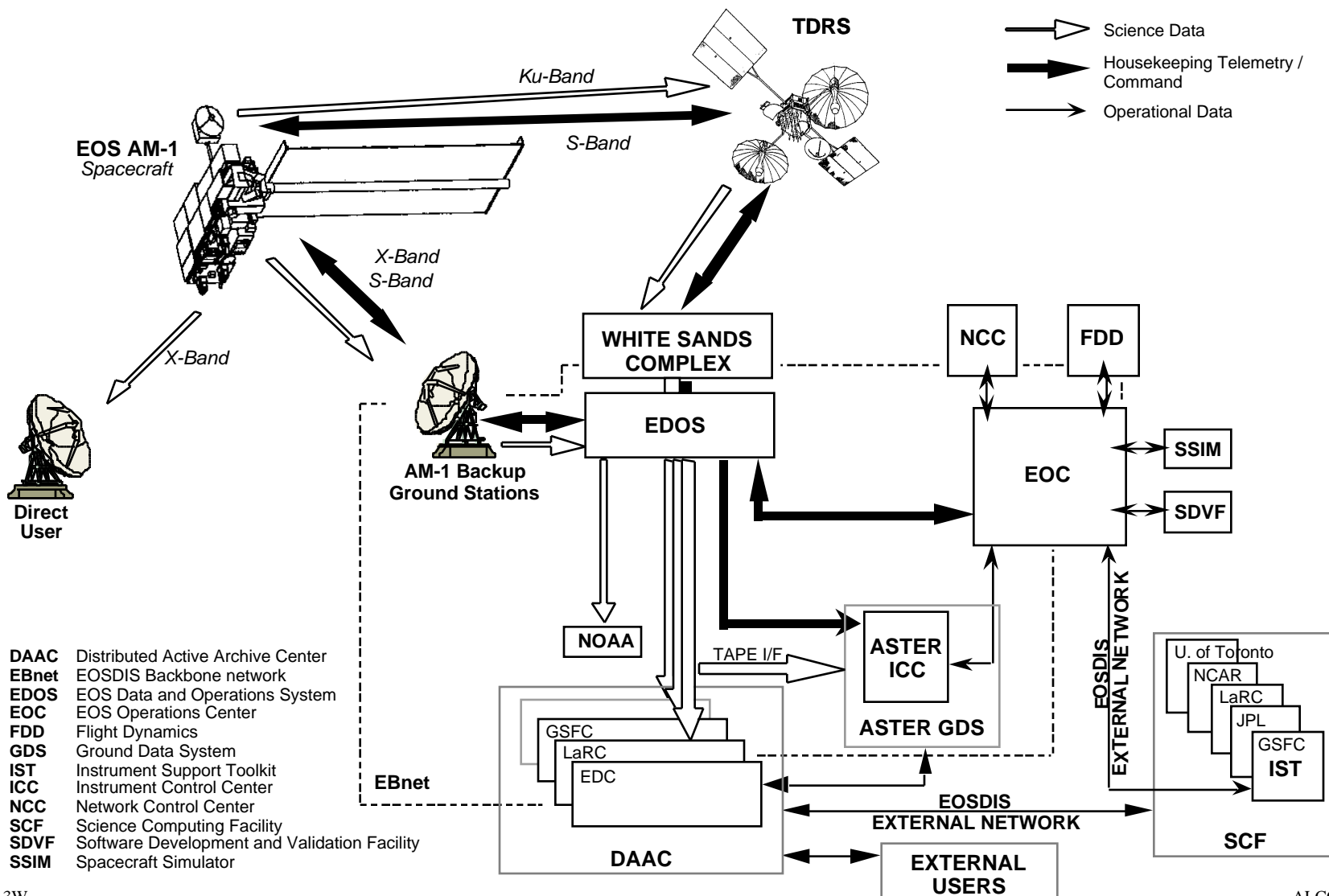
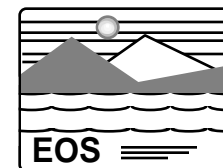


# EOS DATA AND OPERATIONS SYSTEM

**GARY ALCOTT**  
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**Greenbelt, MD 20771 USA**  
**E-mail: [gary.alcott@gsfc.nasa.gov](mailto:gary.alcott@gsfc.nasa.gov)**  
**<http://edos.gsfc.nasa.gov/>**



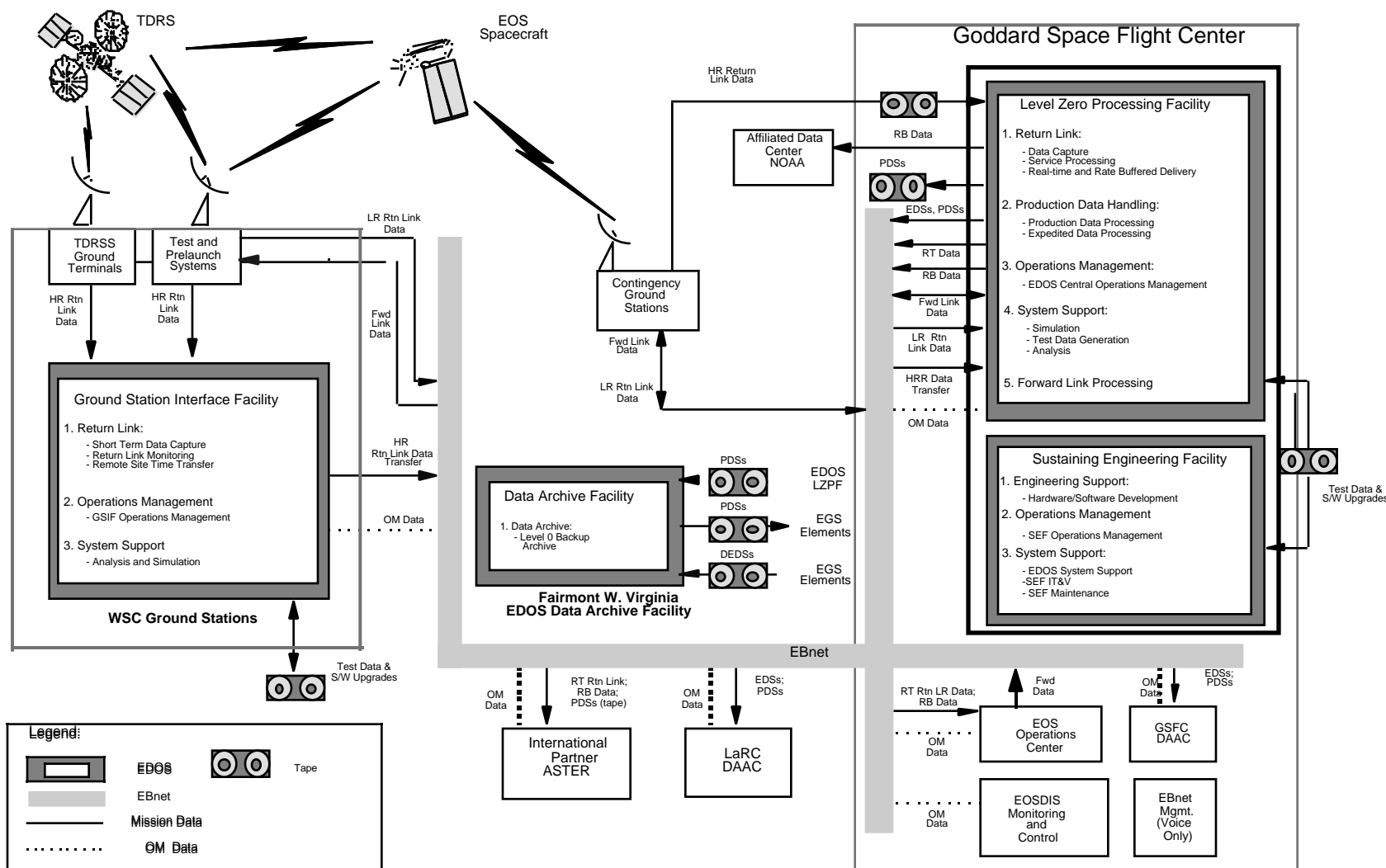
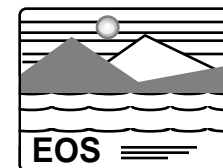
# EOSDIS Ground System Context



- DAAC** Distributed Active Archive Center
- EBnet** EOSDIS Backbone network
- EDOS** EOS Data and Operations System
- EOC** EOS Operations Center
- FDD** Flight Dynamics
- GDS** Ground Data System
- IST** Instrument Support Toolkit
- ICC** Instrument Control Center
- NCC** Network Control Center
- SCF** Science Computing Facility
- SDVF** Software Development and Validation Facility
- SSIM** Spacecraft Simulator

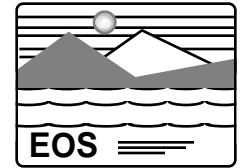


# EDOS Ground System Context

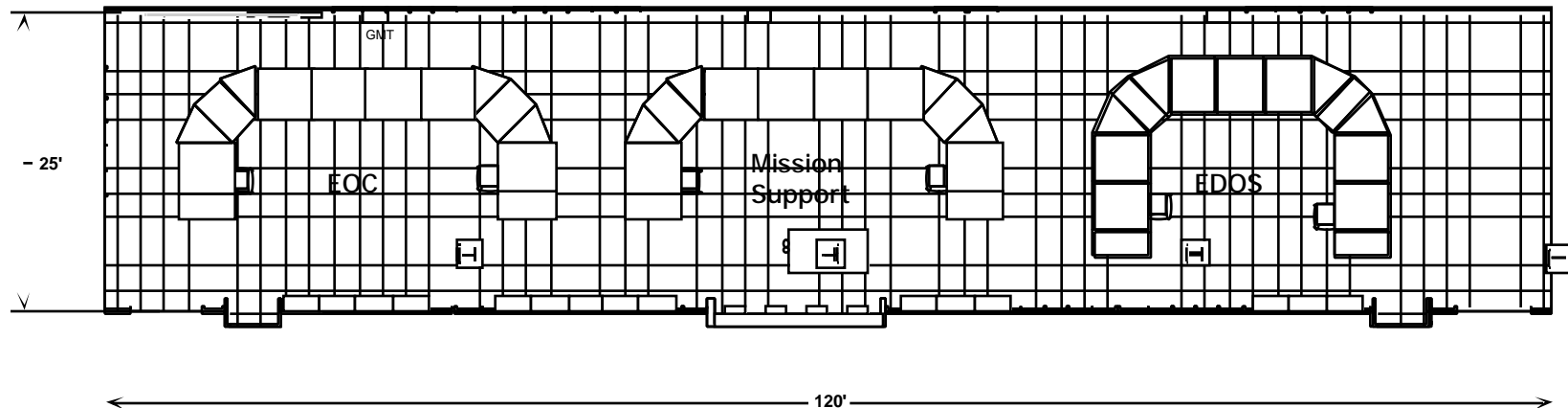




# EDOS Facilities

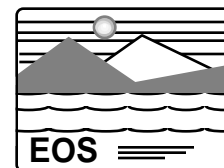


- **Level-Zero Processing Facility (LZPF), Goddard Space Flight Center (GSFC)**
- **Ground Station Interface Facility (GSIF), White Sands Complex (WSC)**
- **Data Archive Facility (DAF), Fairmont, West Virginia**
- **Sustaining Engineering Facility (SEF), GSFC**





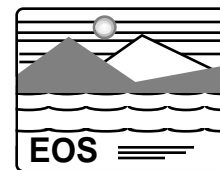
# EDOS Services



- **Forward-link processing**
- **Return-link processing**
  - **Real-time delivery**
  - **Rate Buffered delivery**
- **Production data processing**
  - **Expedited Data Sets (EDSs)**
  - **Production Data Sets (PDSs)**
- **Data archive**
- **Operations management**
- **Sustaining engineering**



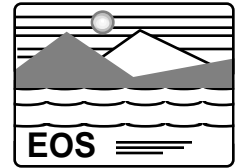
# EDOS AM-1 Processing Requirements



Data Stream	Real-Time Service	Rate-Buffered Service	EDSs	PDSs
Commands	Spacecraft (via TGT)	—	—	—
Non-science	EOC, ASTER ICC	EOC, ASTER ICC	—	GSFC DAAC, ASTER ICC (tapes)
ASTER	—	—	GSFC DAAC	ASTER GDS 2-hour PDSs (tapes)
CERES	—	NOAA	LaRC DAAC	24-hour PDSs LaRC DAAC
MISR	—	—	LaRC DAAC	2-hour PDSs LaRC DAAC
MODIS	—	—	GSFC DAAC	2-hour PDSs GSFC DAAC
MOPITT	—	—	LaRC DAAC	2-hour PDSs LaRC DAAC



# EDOS Operations

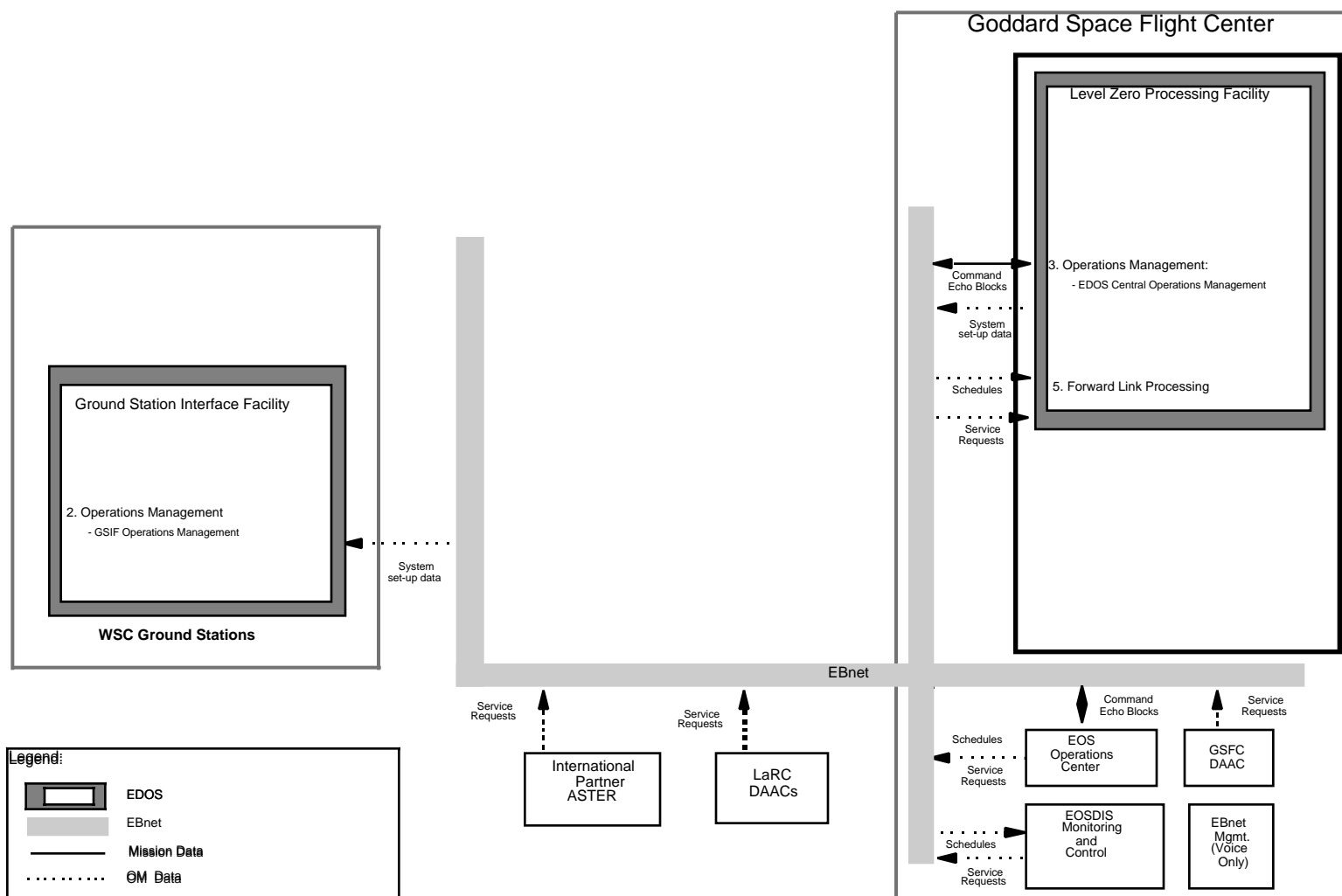
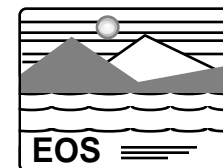


- **Pre-session operations**
- **Real-time operations**
- **Post-session operations**
- **Production operations**
- **Fault isolation**

**Note: There is little difference between L&EO and operational phases**



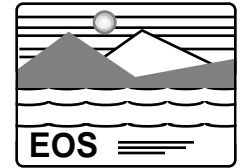
# EDOS Pre-Session Operations







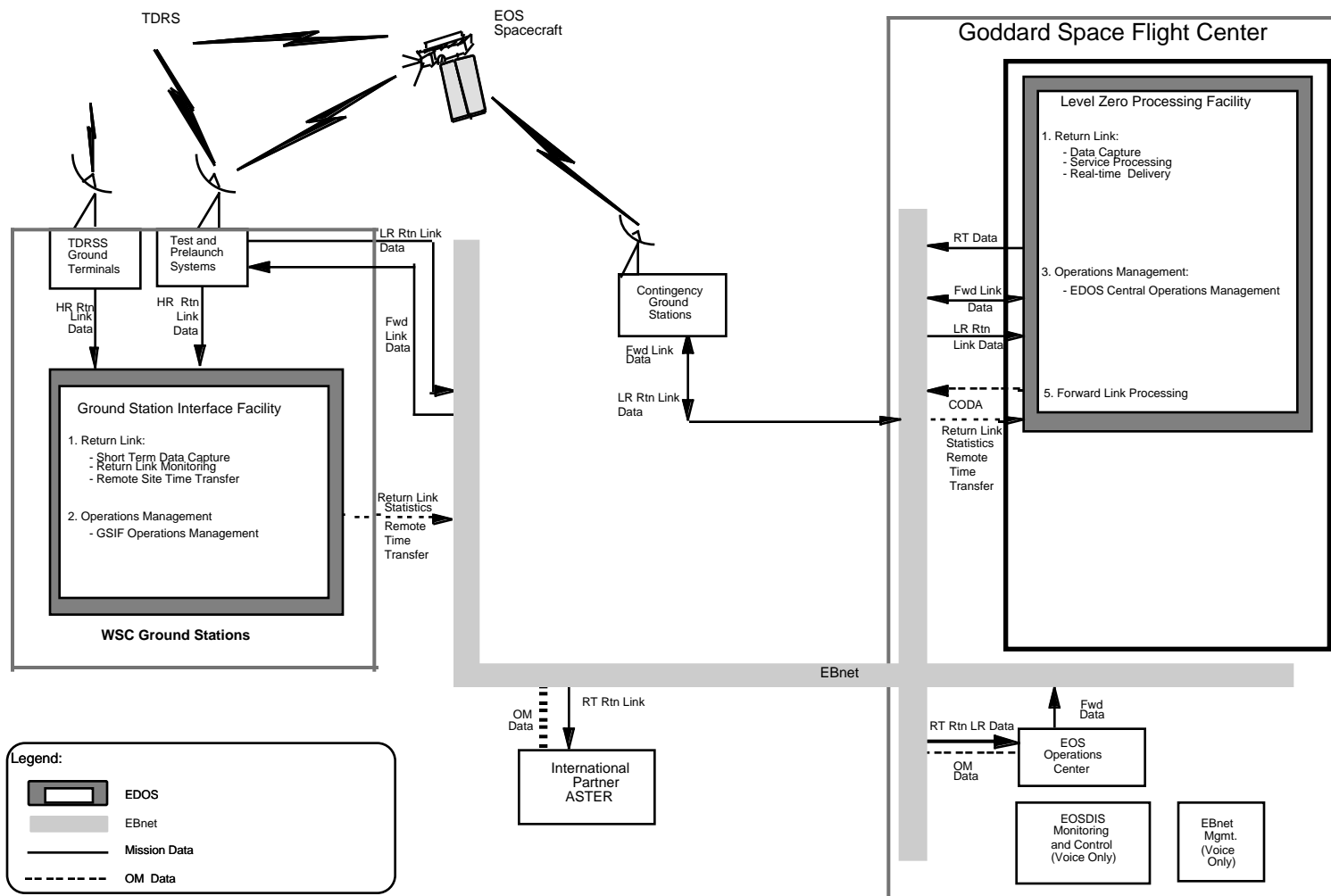
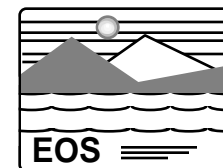
# EDOS Pre-Session Operations



- **Receive Network Control Center (NCC) schedules from EOC**
- **Service requests from EOS Ground System (EGS) elements**
- **Generate EDOS Operational Timeline (EOT) (next 48 hours) and EDOS Activity Plan (EAP) (next 2 weeks)**
- **Use schedules and processing requirements established with external elements to generate control data used to configure system components at GSIF and LZPF for processing and delivery**
- **Voice checks with external elements**
- **Command echo blocks**

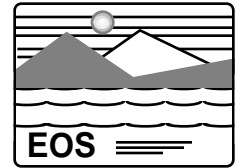


# EDOS Real-Time Operations





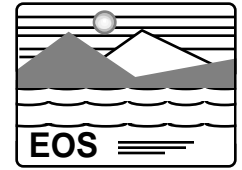
# EDOS Real-Time Operations



- **Real-time mission data processing (LZPF)**
  - **Forward link**
    - » **Receive Command Data Blocks (CDBs) from EOC (up to 10 kbps)**
    - » **Validate CDB source and convert CDBs received via User Datagram Protocol (UDP) to clock and data**
    - » **Transfer clock and data to ground terminal ( $\leq 350$ -msec delay) for uplink**
    - » **Discard invalid CDBs**
    - » **Log incoming and outgoing forward-link data**
  - **Low-rate return link**
    - » **Capture and perform Consultative Committee for Space Data Systems (CCSDS) path processing of low-rate data into EDOS Data Units (EDUs) (up to 512 kbps)**
    - » **Transfer EDUs to user in real time ( $\leq 750$ -msec delay) (up to 64 kbps)**
    - » **Command Link Control Word (CLCW) extraction and processing**



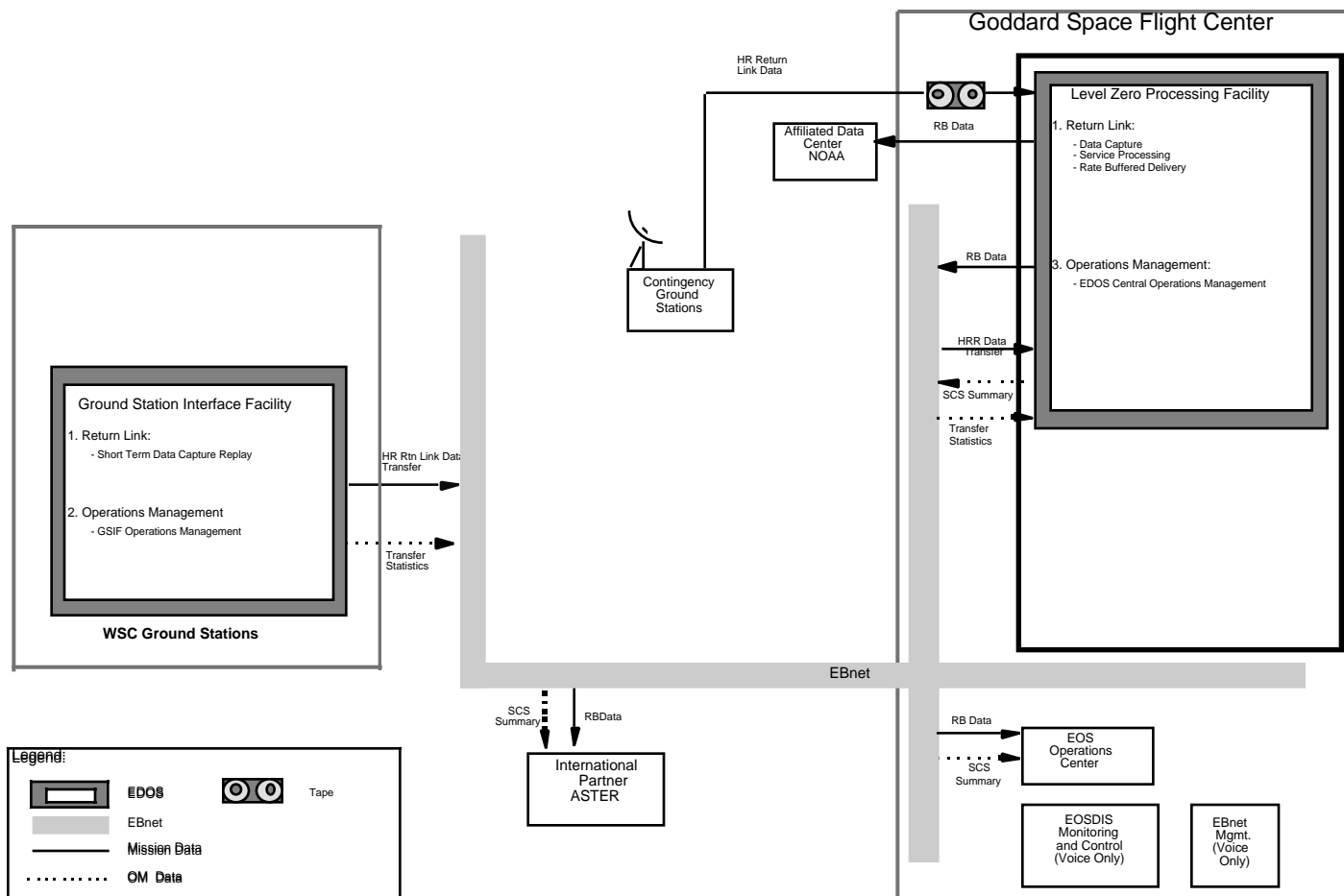
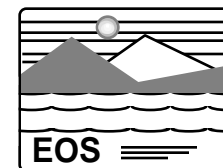
# EDOS Real-Time Operations (Cont'd)



- **High-rate data handling (GSIF)**
  - **High-rate return link**
    - » Capture high-rate return-link data (up to 150 Mbps)
    - » Provide short-term storage of high-rate data
    - » Generate and transfer physical channel statistics to LZPF for CODA reports
- **Real-time reporting (LZPF)**
  - **Customer Operations Data Accounting (CODA) report**
    - » Generate report using real-time (forward link and low-rate return link) and high-rate physical channel statistics
    - » Send to users at 5-second intervals during Spacecraft Contact Session (SCS)

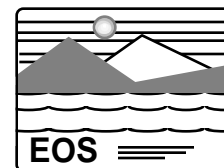


# EDOS Post-Session Operations





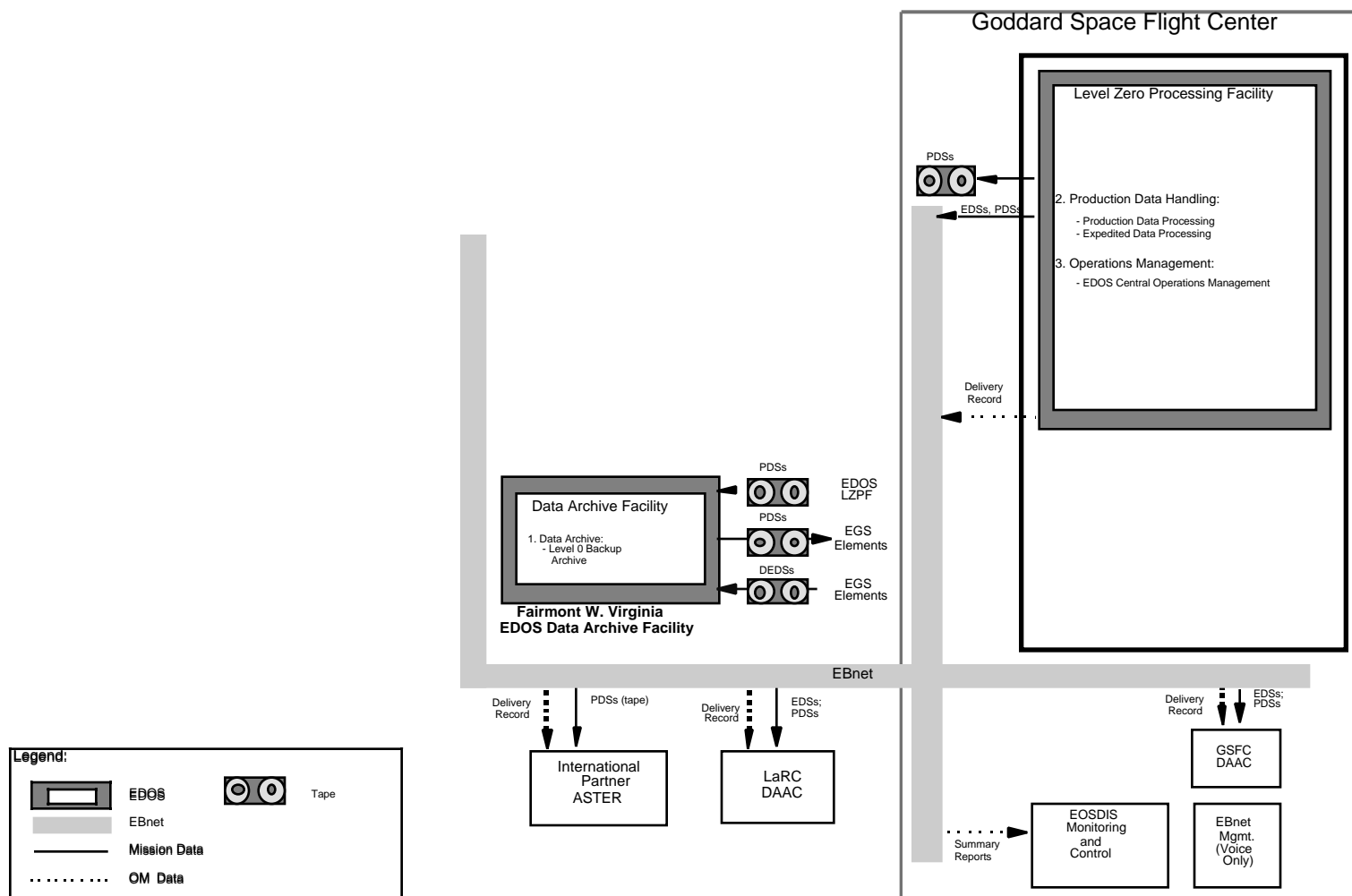
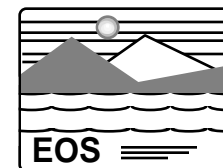
# EDOS Post-Session Operations



- Sessions terminated based on loss of signal and scheduled session stop times
- Automatic initiation of mission data transfers
  - Transfer high-rate data from GSIF to LZPF during Return-Link Service Session (RLSS) (up to 45 Mbps)
  - 30-day data capture storage of high- and low-rate data
- Process high-rate data to EDUs at LZPF during RLSS
  - Deliver rate-buffered EDUs based on user requirements (initiated within 5 minutes from completion of RLSS, nominally within 3 hours of observation) at rates specified in ICD
  - Rate-buffered transfer of trash buffer
  - Transfer EDUs to production data handling for creation of data sets
- Generate and transfer SCS summary reports to users
  - Report contents include real-time and RLSS statistics
  - Report sent to users on completion of RLSS

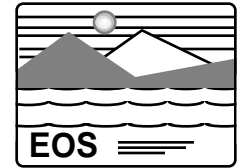


# EDOS Production Operations





# EDOS Production Operations

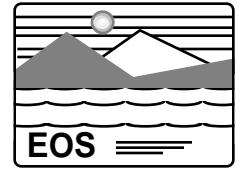


- **Expedited Data Sets**
  - **Identify data to be used in EDSs by**
    - » **Quick-look flag in secondary header**
    - » **Service request**
  - **Include packets from single applications process identifier (APID) from a single SCS**
  - **Deliver electronically to requester within 1 hour after completion of RLSS (within 3 hours of completion of SCS) via File Transfer Protocol (FTP)**
  - **Generate construction records and include with each EDS**
  - **Generate delivery record and transfer (within 1 minute of EDS delivery) for each EDS sent to user**





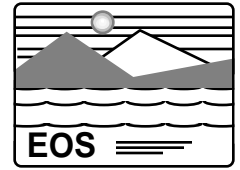
# EDOS Production Operations (Cont'd)



- **Production Data Sets**
  - **Include packets from**
    - » **Fixed time interval (recommend 2-hour data sets)**
    - » **One or more SCSs**
  - **Provide electronic and physical media delivery**
  - **Contain no more than 24 hours of mission data**
  - **Deliver 2-hour data sets within 4 hours of RLSS completion for RLSS containing last packet needs for PDS generation via FTP**
  - **Generate construction records and include with each PDS**
  - **Generate Physical Media Delivery Record and Delivery Letter**
  - **Deliver ASTER PDSs on physical media**



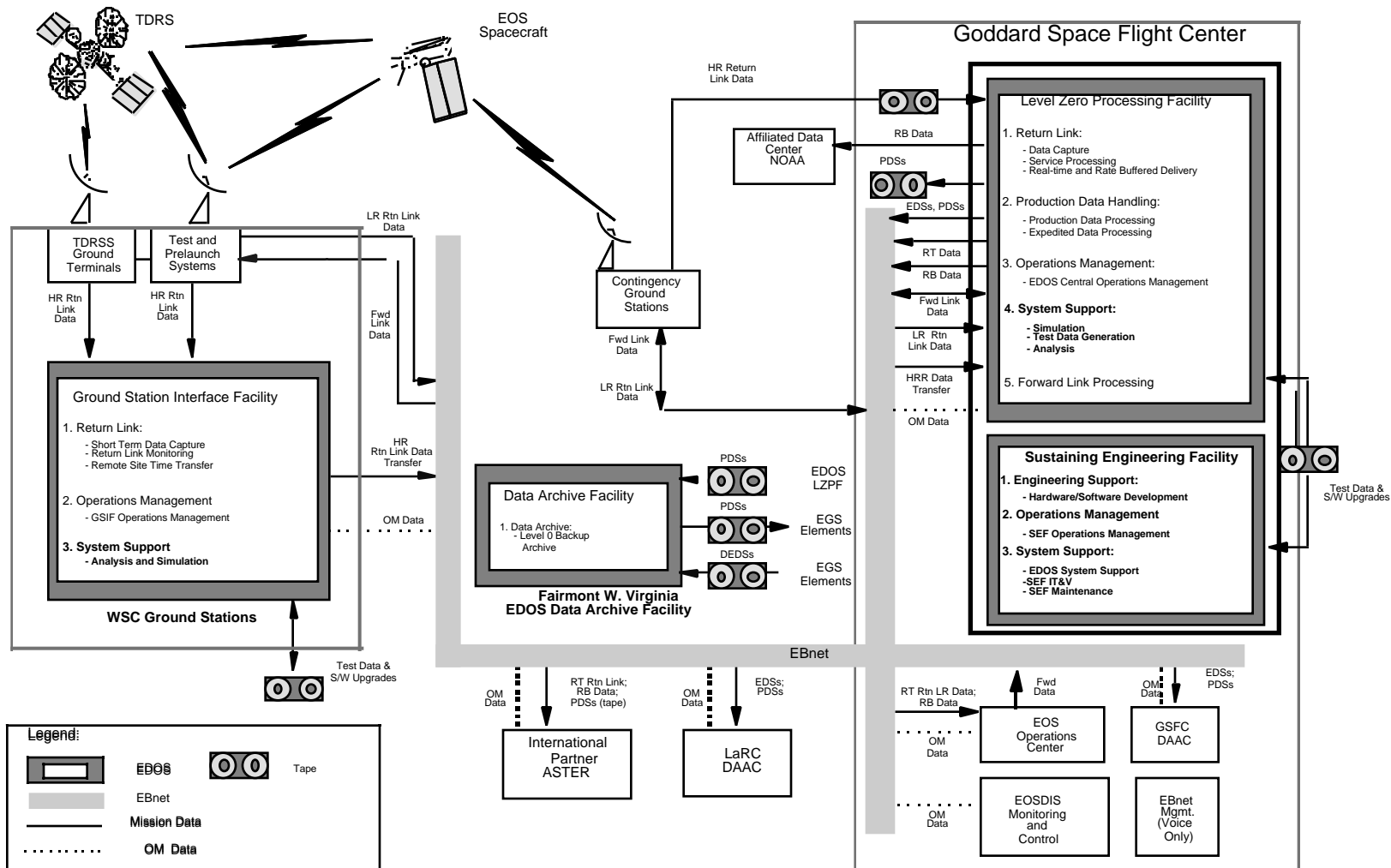
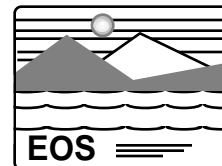
# EDOS Production Operations (Cont'd)



- **Production Data Sets (cont'd)**
  - Generate delivery record and transfer (within 1 minute of PDS delivery) for each PDS sent to user
  - Are automatically placed on media for storage in archive
- **Archive**
  - Archive data are delivered on physical media in event of user data loss
  - Replacement data received on physical media in event of EDOS data loss
- **Summary reporting**
  - Status: Daily, weekly, monthly, and ad hoc summary reports
  - History database (45 days online, archived to tape)

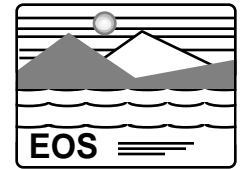


# EDOS Fault Isolation





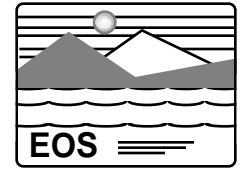
# EDOS Fault Isolation



- **Simulation and analysis tools at each facility**
- **Test data generation to support fault isolation**
- **Collocation of LZPF and SEF**
  - **Availability of additional analysis capabilities and development environment**
  - **Availability of EDOS testbeds**
- **Voice loops with other elements for troubleshooting**
- **Collocation of Flight Operations Segment (FOS) and EDOS operations personnel**



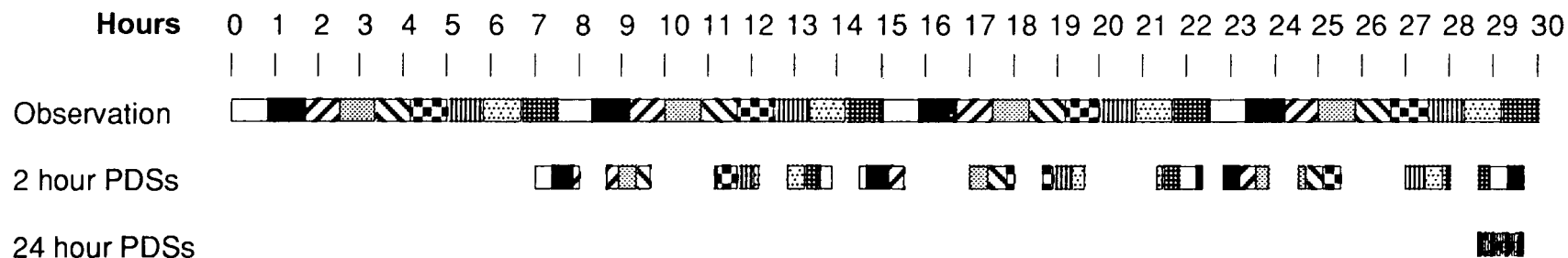
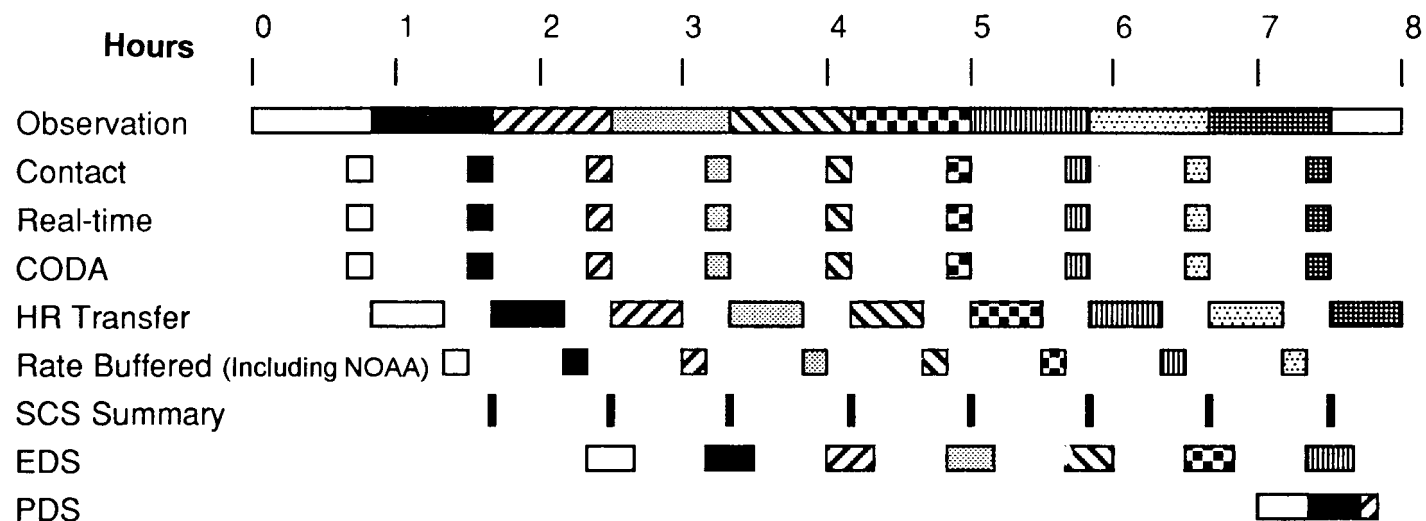
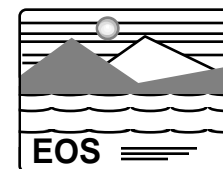
# EDOS System Support and Sustaining Engineering



- **Sustaining engineering at SEF**
  - New mission support
  - Technology insertion
  - System upgrades
  - Hardware and software development environments
  - EDOS testbeds of GSIF, LZPF, and DAF

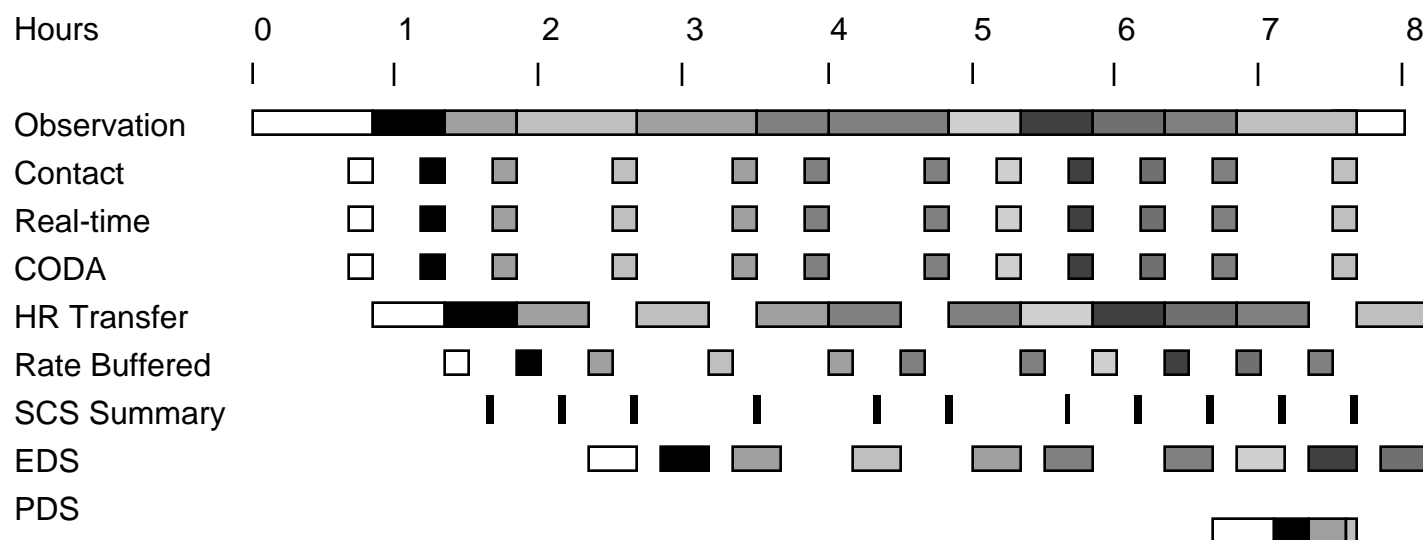
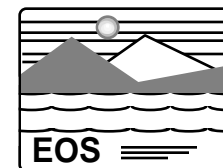


# A "Day in the Life" of EDOS



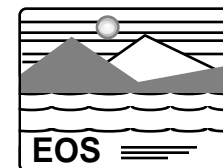


# EDOS Asynchronous “Day”





# EDOS Interface Status

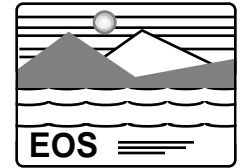


Interface	IRD	ICD	Operations Agreement
EOC	EGS IRD, signed	Signed	Prelim complete signature, 12/97
GSFC DAAC	EGS IRD, signed	Signed	Prelim complete signature, 12/97
LaRC DAAC	EGS IRD, signed	Signed	Prelim complete signature, 12/97
SMC	EGS IRD, signed	Signed	Prelim 6/97 signature, 12/97
ASTER GDS	EGS IRD, signed	Signed	Final complete signature, 12/97
NOAA	Signed	Signed	Prelim complete signature, 12/97
TGT	Signed	Prelim complete signature, 12/96	N/A
EBnet (covers interface with contingency stations)	Signed	Signed	N/A
Backup ground station tapes	N/A	Signed MOU	N/A





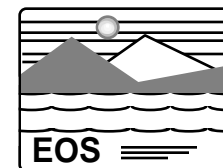
# EDOS Operations Staffing



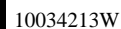
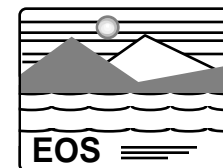
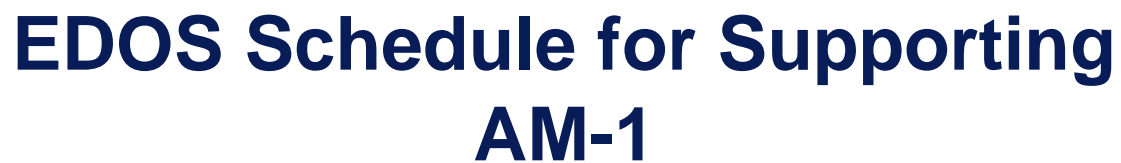
- **Descriptions**
  - **Data analyst**
    - » Performs system monitoring and control; performs initial troubleshooting
    - » Provides around-the-clock support
  - **Mission analyst**
    - » Performs detailed troubleshooting and mission coordination
    - » Works day shift; provides on-call support
  - **Hardware technician**
    - » Performs preventive and corrective maintenance
    - » Provides around-the-clock support; shared with facility
  - **Archive technician**
    - » Performs tape handling and data quality checks
    - » Works day shift
- **Operations and maintenance staffing provided under Code 500 Support Contract**



# EDOS Operations Staffing

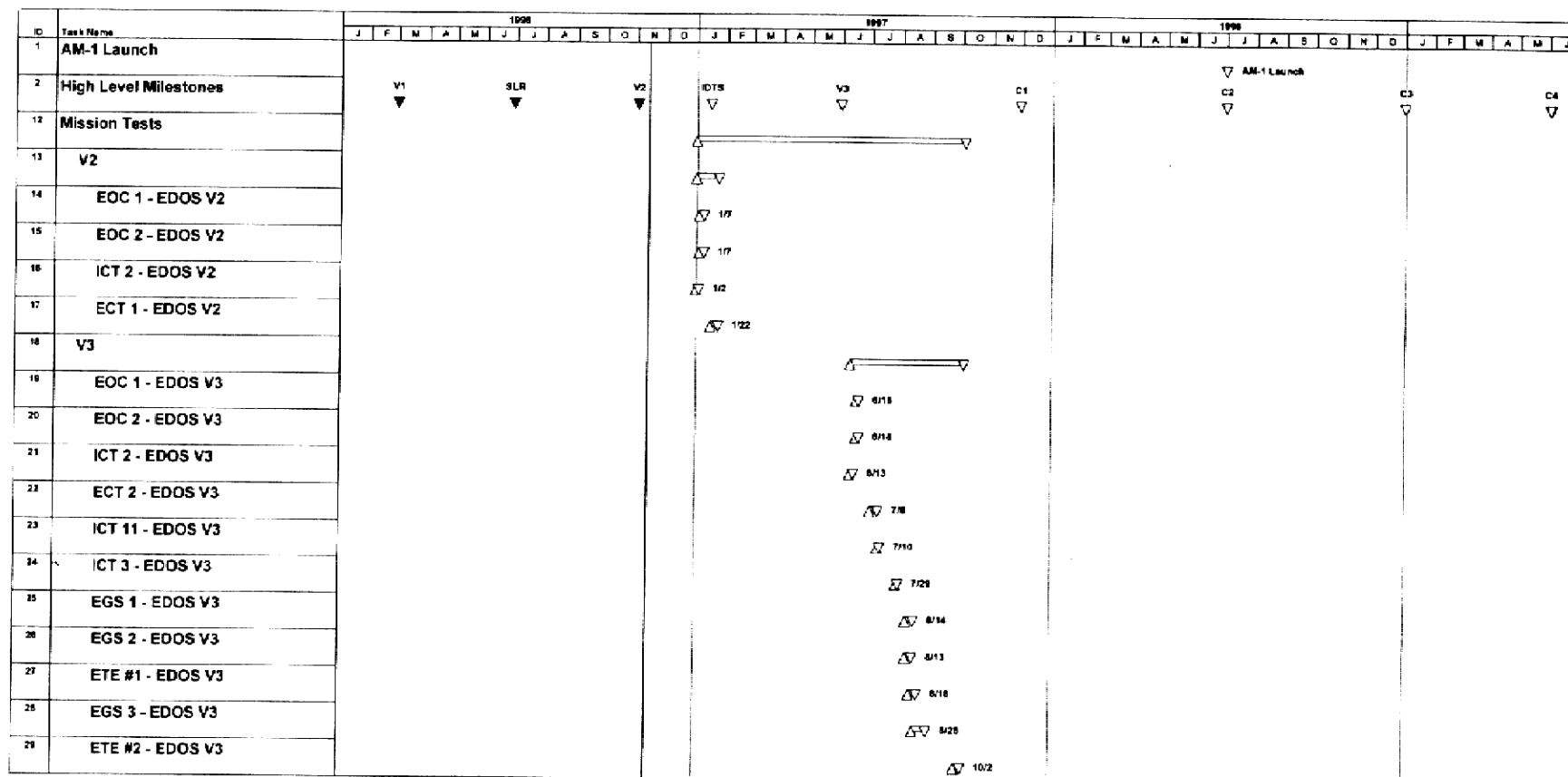
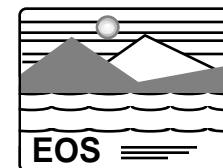


	FY97 V2/V3 Mission Testing	FY98 C1/C2 AM-1 Launch	FY99 C3/C4 Automation	FY00
<b>EDOS (total)</b>	<b>15+7*</b>	<b>24</b>	<b>24</b>	<b>12</b>
<b>LZPF</b>	<b>6+3*</b>	<b>13</b>	<b>13</b>	<b>8</b>
Manager		1	1	1
Secretary		1	1	1
Supervisor	1	1	1	1
Data Analyst	2	5	5	
Mission Analyst	3+2*	3	3	3
Hardware Technician	1*	2	2	2
<b>WSC GSIF</b>	<b>9+4*</b>	<b>9</b>	<b>9</b>	<b>2</b>
Data Analyst	5	5	5	
Mission Analyst	2+3*	2	2	
Hardware Technician	2+1*	2	2	2
<b>DAF</b>		<b>2</b>	<b>2</b>	<b>2</b>
Archive Technician		2	2	2



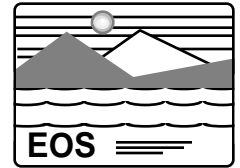


# EDOS Schedule for Supporting AM-1 Mission Testing Detail





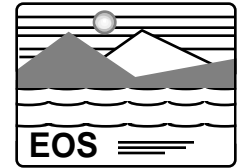
# EDOS Releases



- **V1: Demonstration of significant capabilities**
- **V2: Early mission testing support**
- **V3: Full data processing functionality**
- **C1: Full system and reliability, maintainability, availability (RMA), AM-1 launch configuration**
- **C2: Data archive**
- **C3: System automation and enhancements**
- **C4: Multi-mission capability**



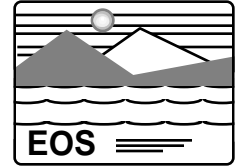
# EDOS Milestone Highlights



- **Completed activity**
  - V1 demonstration
  - V2 installation and demonstration
- **Current activity**
  - Engineering tests with EOC
  - Engineering tests with Valley Forge
  - EDOS overview and operational scenarios training
- **Future activity**
  - EDOS Interfacility Data Transfer Subsystem (IDTS), V3, and C1 deliveries
  - Mission testing and simulations
  - AM-1 launch with C1 delivery
  - EDOS C2, C3, and C4 deliveries



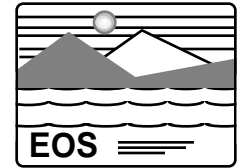
# EDOS Concerns



- **NOAA Requirements Changes**
  - NOAA has requested additional AM-1 data (selected MODIS channels)
  - NOAA has requested a change in data delivery timeline from 3 hours to 2 hours after observation (CERES and new selected MODIS channels)
  - NASA is evaluating



# EDOS Requirements Compliance



- **ESDIS project level 2 requirements, Volumes 0 and 2, and Appendix A**
- **All requirements met**
- **No impact from EOSDIS Core System (ECS) replan**
- **On schedule for launch**